

QUARTERLY PROGRESS REPORT

| Project Title:   |  | Traffic Control and Work Zone Safety for Highway Volume Roads |              |  |                   |                   |                    |
|--|--|---|--------------|--|-------------------|-------------------|--------------------|
| RFP NUMBER:<br>2010-02   |  |   |              | NJDOT RESEARCH PROJECT MANAGER:<br>Ed Kondrath |                   |                   |                    |
| TASK ORDER NUMBER:<br>TO 248/ RU Acct. 432051  |  |   |              | PRINCIPAL INVESTIGATOR:<br>Dr. Kaan Ozbay      |                   |                   |                    |
| Project Starting Date: 1/1/2010<br>Original Project Ending Date: 12/31/2011<br>Modified Completion Date: 7/01/2012 |  |   |              | Period Covered: 3 <sup>rd</sup> Quarter 2011   |                   |                   |                    |
| Task #   | Task   | % of Total  | Fixed Budget | % of Task this quarter                         | Cost this quarter | % of Task to date | Total cost to date |
| 1  | Literature Search + Focused State-of-Practice Review       | 20.13%  | \$ 56,000    | 0.00%  | \$ -              | 100.00%           | \$ 56,000          |
| 2  | Data Collection and Analysis                               | 20.01%  | \$ 55,689    | 10.00%   | \$ 5,569          | 60.00%            | \$ 33,412          |
| 3  | Development of Safety Recommendations                      | 9.70%   | \$ 27,000    | 10.00%   | \$ 2,700          | 60.00%            | \$ 16,200          |
| 4  | Assessment of Innovative Technologies Through Lab Tests    | 9.70%   | \$ 27,000    | 20.00%   | \$ 5,400          | 75.00%            | \$ 20,250          |
| 5  | Field Tests of Selected Advanced Safety Technologies       | 17.25%  | \$ 48,000    | 0.00%  | \$ -              | 0.00%             | \$ -               |
| 6  | Development of Final Safety Guidelines and Recommendations | 16.99%  | \$ 47,276    | 10.00%   | \$ 4,728          | 20.00%            | \$ 9,455           |
| 7  | Training and Technology Transfer                           | 0.00%   | \$ -         | 0.00%  | \$ -              | 0.00%             | \$ -               |
| 8  | Project Management, Final and Quarterly Reports            | 6.22%   | \$ 17,279    | 0.00%  | \$ -              | 70.00%            | \$ 12,096          |
| 9  |  | 0.00%   | \$ -         | 0.00%  | \$ -              | 0.00%             | \$ -               |
| 10   |  | 0.00%   | \$ -         | 0.00%  | \$ -              | 0.00%             | \$ -               |
| 11   |  | 0.00%   | \$ -         | 0.00%  | \$ -              | 0.00%             | \$ -               |
| 12   |  | 0.00%   | \$ -         | 0.00%  | \$ -              | 0.00%             | \$ -               |
| 13   |  | 0.00%   | \$ -         | 0.00%  | \$ -              | 0.00%             | \$ -               |
| 14   |  | 0.00%   | \$ -         | 0.00%  | \$ -              | 0.00%             | \$ -               |
| 15   |  | 0.00%   | \$ -         | 0.00%  | \$ -              | 0.00%             | \$ -               |
| 16   |  | 0.00%   | \$ -         | 0.00%  | \$ -              | 0.00%             | \$ -               |
| 17   |  | 0.00%   | \$ -         | 0.00%  | \$ -              | 0.00%             | \$ -               |
| 18   |  | 0.00%   | \$ -         | 0.00%  | \$ -              | 0.00%             | \$ -               |
| 19   |  | 0.00%   | \$ -         | 0.00%  | \$ -              | 0.00%             | \$ -               |
| 20   |  | 0.00%   | \$ -         | 0.00%  | \$ -              | 0.00%             | \$ -               |
| <b>TOTAL</b>   |  | 100.00%   | \$ 278,244   |  | \$ 18,396         |                   | \$ 147,413         |

Blue text is entered once at the beginning of the project

Green text is updated ever quarter

Black text is automatically updated or static

**Project Objectives:**

**Objective 1:** *Scanning*

- Step 1. Assess current state-of-the art in work zone control and safety with an emphasis on high speed and high volume roadways where surveyors and inspectors are required to work.

Assess current state-of-the art in work zone control and safety with an emphasis on high speed and high volume roadways where surveyors and inspectors are required to work.

- a. Conduct literature review related to work zone control and safety.
- b. Develop and conduct interviews with a number of States that have already focused on these issues.

**Objective 2:** *Field Data Collection*

- Step 2. Develop an experimental set-up to collect field data while NJDOT employers are performing their work.

- a. In close cooperation with NJDOT, select sites at which data will be collected to be tested.

- Step 3. Develop data collection plan that clearly describes the way field data will be collected along with the type of data that need to be collected (number of intrusion into work zone, dangerous maneuvers by cars traveling next to the work zone, speed of individual cars etc.)

- Step 4. Implement the data collection plan

- a. In close cooperation with NJDOT, collect field data.
- b. Process and analyze field data

**Objective 3:** *Synthesis*

- Step 5. Develop recommendations and guidelines based on the previous two phases.

**Objective 4:** *Selection and Assessment of Most Promising Technologies*

- Step 6. Using the findings of Phase 1, identify most promising “work zone intrusion warning” technologies along with a statistically robust ranking methodology.

- a. In close cooperation with NJDOT, select one or maximum two top technologies for lab and / or field testing.

- Step 7. Develop and implement a data collection plan that clearly describes the way lab / field data will be collected for the selected technologies.

- a. In close cooperation with NJDOT, collect field data.
  - b. Process and analyze field data.
- Step 8. Use the collected data to develop recommendations for the tested technologies.
- a. Use the real-world field data along with cost data to quantify benefits and costs of the tested technologies
  - b. Develop revised work zone control / safety guidelines for high speed high volume roadways by incorporating the tested technologies.

**Project Abstract:**

The Manual on Uniform Traffic Control Devices (MUTCD) predominantly addresses work performed along the centerline of roadways and low speed roads. This work does not apply to the majority of situations encountered by NJDOT employees who survey or inspect high speed, high volume roadways. Therefore, there is a need to review current practices being used by other state DOT's and develop guidance for traffic control and work zone safety on high volume roads for this targeted group.

Temporary traffic control is typically performed on high volume roadways in accordance with directives of the Manual on Uniform Traffic Control Devices. Set-up and removal of lane and shoulder closures is frequently undertaken by maintenance forces. The protection of employees and the public is the primary consideration when temporary traffic control measures are used.

Several factors need to be addressed when temporary traffic controls are implemented to minimize hazards on roadways.

- Prevailing traffic speed,
- Peak traffic hours,
- Motorists' sight distances,
- Effect of unusual survey activities on traffic,
- Pavement conditions – wet, frosty, etc, and
- Special conditions and events, such as school hours and large public gatherings.

1. Progress this quarter by task:

**Task 1. Literature Search / Focused Review of the State-of-the Practice:**

We completed the review of the available literature on the work zones and their control.

**Task 2. Data Collection and Analysis**

In this quarter, we have conducted one site visit with the Land Surveying crew and six site visits with the Bridge Inspectors. The detailed information regarding these visits is shown in the table below.

| Location               | Date       |
|------------------------|------------|
| Route 35, Belmar, NJ   | 06/09/2011 |
| I-78, Lebanon, NJ      | 06/14/2011 |
| Route 33, Howell, NJ   | 06/15/2011 |
| I-78, Phillipsburg, NJ | 06/28/2011 |
| Route 41, Lakeland, NJ | 06/30/2011 |
| Route 55, Vineland, NJ | 07/13/2011 |
| Route 130, Camden, NJ  | 07/15/2011 |

RITS team collected approximately 7.5 hours of traffic data, which are being extracted by NJIT and TCNJ to obtain various safety parameters.

During the site visit with the Surveying Crew on June 9, 2011, we tested the effectiveness of Road Quake on Route 35 in Belmar. We recorded the traffic with and without rumble strips. Once the data are extracted, we will have a clear understanding whether the portable rumble strips reduced vehicle speeds or not.

### **Task 3: Development of Safety Recommendations**

We prepared a draft that describes safety related issues and remedies using the information from Tasks 1 and 2. We are working on processing and analyzing the data collected in task 2 to develop safety recommendations based on observations. We are also analyzing historical work zone accident records for utility and maintenance types to develop a better understanding of the observed data.

### **Task 4 Assessment of Innovative Safety Technologies through Lab Tests**

During the last quarterly meeting it was the consensus that the Turbo Flare was not bright enough during day light and that it might not be effective for warning drivers of roadside activity. Another issue that was raised was the weak noise given by the beeper when Turbo Flare was moved. We reached out to the manufacturer and suggested these improvements. However, these additions might take time for them to incorporate for their new line of products.

Therefore, RITS team identified two other low cost devices that could warn drivers of roadside activities:

- (1) Personal Strobe Light
- (2) LED Barricade Light

We ordered 5 personal strobe lights and 10 LED barricade lights.

Personal strobe light is 4" x 1.34" in size and weighs 5.2 oz. It has 3 mile visibility in dark and half a mile visibility in day light. It is powered by one "D" cell alkaline battery which lasts 60 hours. The strobe light is waterproof and flashes 50 to 70 times per minute.

LED barricade light, shown in Figure 1, has 400 LED lights which is 16 times brighter than the Turbo Flare, making it more visible during day light. They are easily deployable on the pavement since they have a flat base, but they can also be mounted on a barricade if needed.



**Figure 1. LED Barricade Light<sup>1</sup>**

We have received these products and anticipate starting lab tests before the end of this quarter.

#### **Task 5: Field Evaluation of Selected safety Technologies**

We are in the process of conducting field evaluations with the Road Quake (portable rumble strips) as well as documenting our findings.

#### **Task 6: Development of Final Safety Guidelines & Recommendations**

We started to work on the extensive analysis of the qualitative and quantitative data we collected. It is important to emphasize that observed data is extensive and needs to be interpreted using appropriate statistical techniques. We are in the process of developing the compilation of guidelines for improving work zone safety of surveyors and inspectors through the use of technologies being tested in the previous tasks as well as other recommendations based on reviews of literature, interviews, field assessments and other relevant information.

#### **2. Proposed activities for next quarter by task:**

##### **Task 2:**

Although we collected sufficient field data to determine how exposed the surveyors and bridge inspectors are to traffic, we will conduct additional field data collection to test the efficiency of road quake, personal strobe lights and LED barricade lights in the next quarter.

<sup>1</sup> [http://www.grainger.com/Grainger/CORTINA-Barricade-Light-6FGJ7?cm\\_mmc=GoogleBase-\\_-Safety-\\_-Traffic%20Safety-\\_-6FGJ7&ci\\_src=14110944&ci\\_sku=6FGJ7](http://www.grainger.com/Grainger/CORTINA-Barricade-Light-6FGJ7?cm_mmc=GoogleBase-_-Safety-_-Traffic%20Safety-_-6FGJ7&ci_src=14110944&ci_sku=6FGJ7)

Task 3:

We will continue to work on this task.

Task 5:

We will start field evaluation of the two new safety technologies and at least one more field evaluation of Road Quake.

Task 6:

We will continue to work on this task.

3. List of deliverables provided in this quarter by task (product date):

A progress report will be prepared by the end of this quarter.

4. Progress on Implementation and Training Activities:

5. Problems/Proposed Solutions:

Last year we have made a decision that Rutgers team would collect the actual field collections for all the locations to ensure reliability of the data as well as to avoid additional problems related to field data collection if NJIT and TCNJ teams were to do the field collection themselves. We have also decided to increase the number of field data collection since Rutgers team could be more efficient in this task. NJIT and TCNJ teams were given the task of extracting, processing, and recording video data in terms of certain variables identified by the research team. All these increased the field amount of work required from the Rutgers team but improved the amount and quality of data and could be done without a need for additional resources.

|                                    |            |
|------------------------------------|------------|
| Year 1 Budget                      | \$ 157,946 |
| Years 1 & 2 Cumulative Budget      | \$ 278,244 |
| Years 1, 2 & 3 Cumulative Budget   |            |
|                                    |            |
| Total Project Budget               | \$278,244  |
| <b>Modified Contract Amount:</b>   |            |
| Total Project Expenditure to date  | \$188,742  |
| % of Total Project Budget Expended | 67.83%     |

NJDOT Research Project Manager Concurrence: \_\_\_\_\_ Date: \_\_\_\_\_